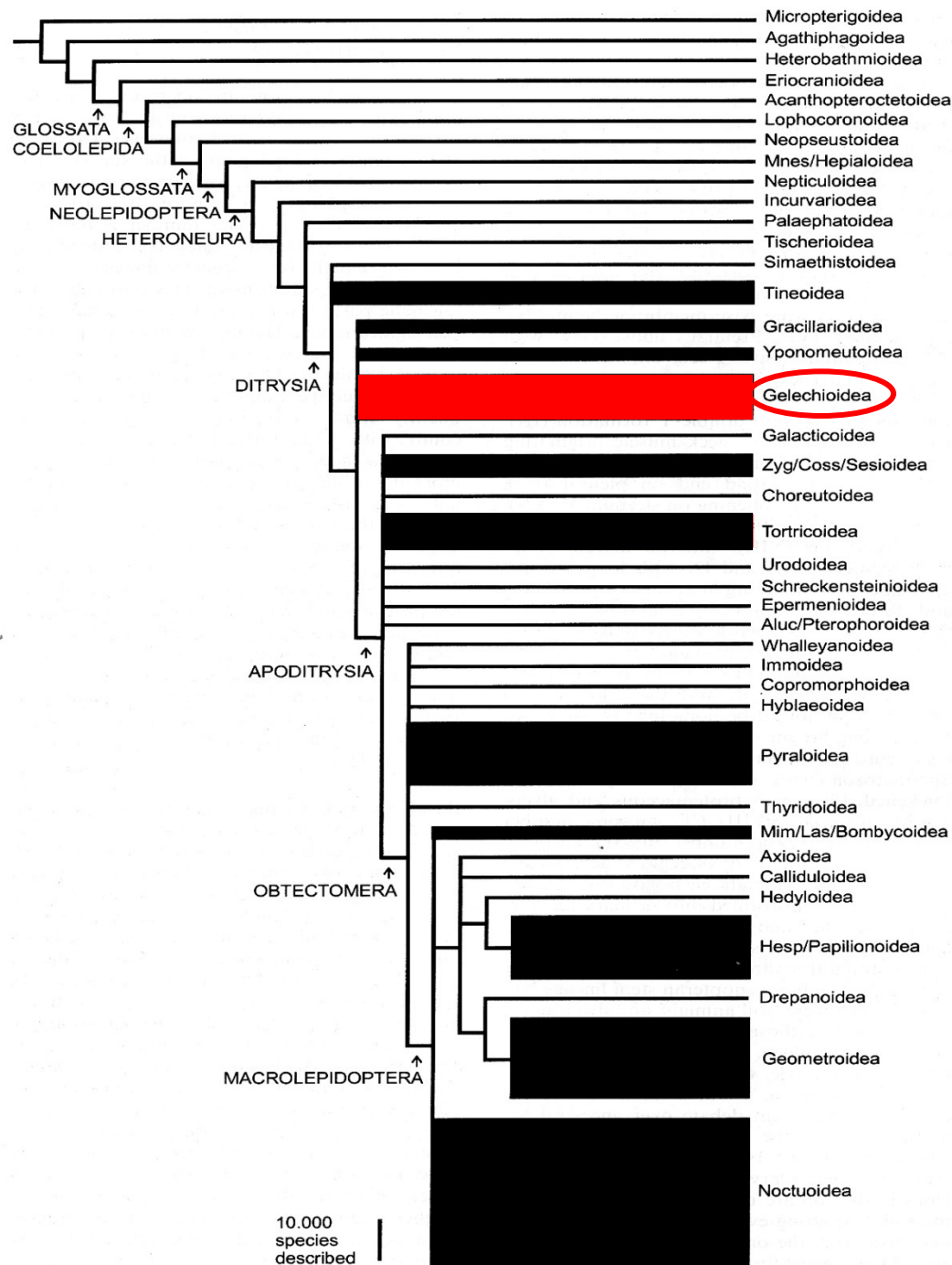


The Major Families of Gelechioidea (Lepidoptera) in North America

Sangmi Lee

Hasbrouck Insect Collection
Arizona State University



Superfamily Gelechioidea

- More than 16,000 described species in at least 1,425 genera worldwide
- About 1,600 species in 205 genera in America north of Mexico

(Kristensen , 1998)

Classification of Gelechioidea

Hodges (1998)

Kaila (2004)

Nieukerken *et al.* (2011)

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Phylogeny of the superfamily Gelechioidea (Lepidoptera: Ditrysia): an exemplar approach

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Accepted 12 May 2004

Abstract

Phylogenetic relationships within the megadiverse lepidopteran superfamily Gelechioidea have been poorly understood and consequently the family level classification has been problematic. An analysis of phylogeny using 193 characters, including 241 informative character states, derived from larval, pupal and adult morphology and larval ecology, was performed to resolve the phylogeny of the Gelechioidea. 143 species representing the diversity of the putative Gelechioidea were included, supplemented with 13 species representing 11 other Ditrysian families. The monophyly of the Gelechioidea was supported, although only with homoplastic characters. The putative position of the Gelechioidea as the sister group of the Apoditrysia was not supported, since the Gelechioidea was nested within this clade. The Gelechioidea was divided into two main lineages: (1) the gelechiid lineage constituting Deocloidae, Syringopinae, a re-composed Coleophoridae (including Coleophorinae and Batrachodesinae as paraphyletic Xyloryctidae of authors, some oecophorids of authors, Deuterogoniinae and Blastobasinae), Oecophoridae s.s., Amphibolidae s.s., Carcinoidea, Stenomatidae, Elachistidae (including Depressariinae s.s., Teleiomyiinae, Ethmiinae, Hypertropiinae s.l., miscellaneous "amphibolids" sensu authors, Acolathinae, Parametristiinae, Agonoxeninae and Elachistinae). Detritivory/fungivory may have evolved only twice within Gelechioidea, though the evolution of larval food substrate use frequently reverses. To avoid an unnecessary further proliferation of names, it is recommended that no further family group names are introduced within the Gelechioidea, unless based on a rigorous analysis of inter-relationships.

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Gelechioidea is a cosmopolitan, megadiverse radiation of Lepidoptera, belonging to "Microlepidopteran" Ditrysia. The superfamily comprises over 16 000 described species (Hodges, 1998) and innumerable undescribed ones. For example, according to Hodges (1998) only 10–40% of species are presently named in several species-rich gelechioidean families in the Nearctic region. The ratio is probably similar, or even worse, in other regions of the World, except in Europe and Russian Asia. For example, in the Sub-Saharan Africa, only the Gelechiidae and Lecithoceridae of South Africa have been more thoroughly studied (Janse, 1969–54; Janse, 1958–63).

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Gelechioidea may be the least known superfamily of Lepidoptera (Hodges, 1998) and it may eventually be among the three largest lepidopteran radiations together with Pyraloidea and Noctuoidea.

The spectrum of lifestyles among gelechioid larvae is diverse. Among the taxa there are predators of other insects, scavengers, detritus and fungus feeders, although feeding on living plant material is prevailing. Species dependent on living plant tissue can be external feeders, borers or miners of any plant tissue: roots, stems, leaves, flowers or seeds (Powell *et al.*, 1998). Larvae in several gelechioidean lineages bear portable cases. Many of the external feeders conceal themselves within silky tents or webs, or by tying leaves. Some shelter in silky galleries in the soil from which they consume plant roots or attack leaf rosettes or other above-ground parts of plants.

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Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness

Nieukerken, E.J. van, *et al.*

Order **Lepidoptera** Linnaeus, 1758 (4 suborders) (15,578 genera, 157,424 species, 50.84) : 2.2

† **Unassigned early lepidopterans** (4 families)

† Family **unassigned** (12 genera, 16 species, 12/16) ⁴

† Family **Archaeolepididae** Whalley, 1985 (1 genus, 1 species, 1/1) ⁴

† Family **Mesochristenseniidae** Huang, Wei & Min, 2010 (1 genus, 3 species, 1/3) ⁴

† Family **Eolepidopterigidae** Rasmitsyn, 1983 (1 genus, 1 species, 1/1) ⁷

† Family **Undopterigidae** Kodov, 1988 (1 genus, 1 species, 1/1) ⁴

Suborder **Zeugloptera** Chapman, 1917 (1 superfamily)

Superfamily **Micropterigoidae** Hennig-Schäffer, 1855 (1 family)

Family **Micropterigidae** Hennig-Schäffer, 1855 (21 genera, 160 species, 3/6) ⁴

Suborder **Aglossata** Spädel, 1977 (1 superfamily)

Superfamily **Agathiphagoidea** Kristensen, 1967 (1 family)

⁴By Erik J. van Nieukerken, Lauri Kaila, Im J. Kitching, Niels P. Kristensen, David C. Lees, Jodi Min, Charles Norg, Marco Nuss, Teresa C. Riegler, Thomas J. Simonsen, Nikolai S. Shtrom, Sheng-Ren Yan, Rana Zahedi, David Adamski, Joaquin Ballester, Daniel Bapich, Bengt A. Bengtsson, John W. Brown, Sibyl Rae Bucheli, Donald R. Davis, Jaraquá De Pinna, Willy De Pinna, Marc E. Eysenck, Patricia Gassio-Pool, Cees Gielis, Peter Hübner-Schäffer, Axel Krombein, Jeremy D. Holloway, Axel Kuhn, Ole Karsholt, Akiko Y. Kawanabe, Sanku C. K. Kotte, Nikolai V. Kodov, J. Donald L. Hovum, Gerardo Lamas, Jean-François Lander, Sangeun Lee, Matthias Nuss, Kyu-Tak Park, Carla Perez, Jadwiga Rota, B. Christian Schmidt, Alexander Schlottemmer, Jan-Christoph Scholz, M. Alma Solis, Gerhard M. Tschorn, Andrew D. Warren, Susan Waller, Roman V. Yakovlev, Vadim V. Zolotarev, Andreas Zwick

⁷The classification largely follows that in the Handbook of Zoology (Kristensen, 1998), and the later updates (Kristensen *et al.* 2007). Recent molecular studies of Ditrysia (Ragge *et al.* 2009; Murman *et al.* 2010) are responsible for several novelties, such as the position of the butterflies (**Papilionoidea**) and the synonymy of **Spinoidea** with **Noctuoidea**.

⁸When possible, numbers of genera and species are based on counts in existing databases, whether published (then cited) or personal. Where not available, often for larger taxa, numbers provided by Handbook authors were updated with Zoological Record data (up to early July 2011). **Lepidoptera** (**Macropodae** *et al.* 2007) has been an additional source.

Fifteen families of North American Gelechioidea

Autostichidae
Batrachedridae
Blastobasidae
Chimabachidae*
Coleophoridae
Cosmopterigidae
Elachistidae
Gelechiidae

Lypusidae
Momphidae
Oecophoridae
Peleopodidae
Pterolonchidae
Schistonoeidae
Scythrididae

*introduced into the Northwest

Eight families of North American Gelechioidea

Autostichidae

Batrachedridae

Blastobasidae

Chimabachidae

Coleophoridae

Cosmopterigidae

Elachistidae

Gelechiidae

Lypusidae

Momphidae

Oecophoridae

Peleopodidae

Pterolonchidae

Schistonoeidae

Scythrididae

Gelechioidea

✓ Forewing length of adults: 2.0 mm to 35 mm.



Gelechioidea

- ✓ Haustellum (Proboscis) scaled
(also in Pyraloidea and Choreutoidea)



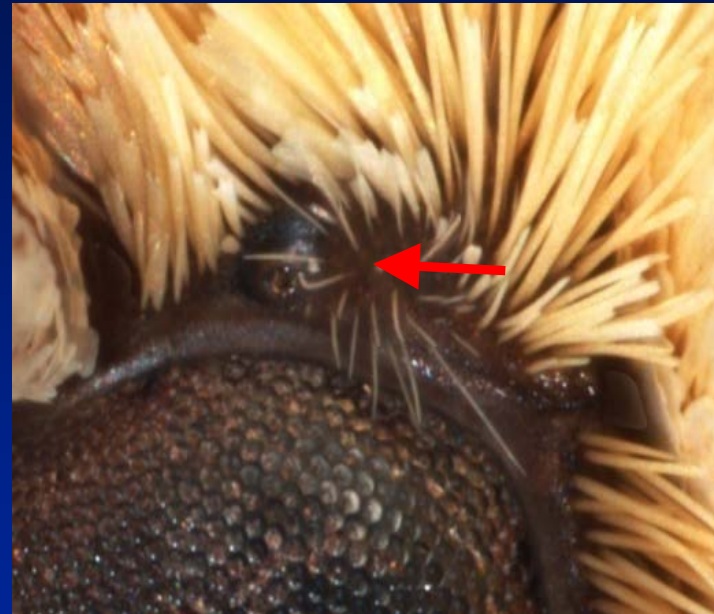
Gelechioidea

- ✓ Haustellum (Proboscis) scaled (also in Pyraloidea and Choreutoidea)
- ✓ Labial palpus three segmented, usually upturned



Gelechioidea

✓ Chaetosemata absent



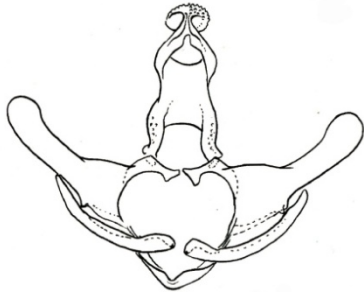
Chaetosemata in Tortricidae

Gelechioidea

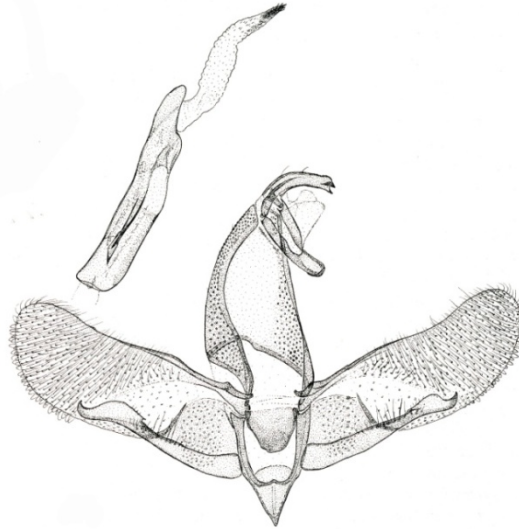
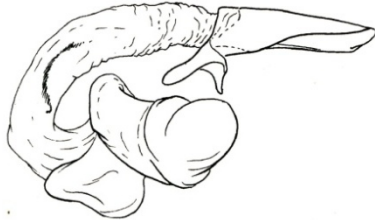
- ✓ Dorsal surface of hind tibia with long, slender scales



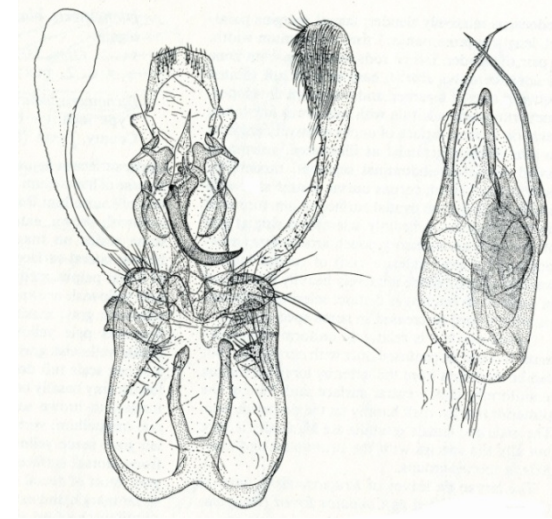
Male genitalia of Gelechioidea



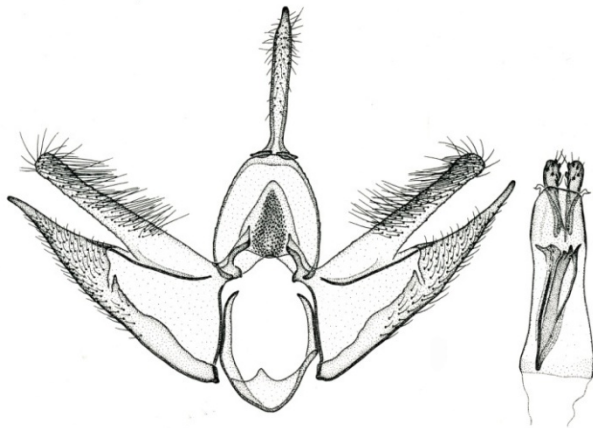
Coleophoridae



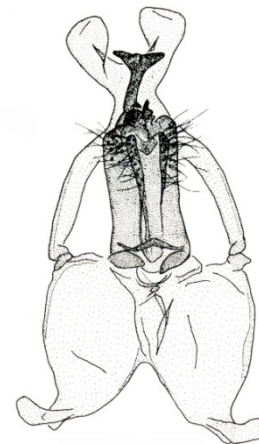
Autostichidae



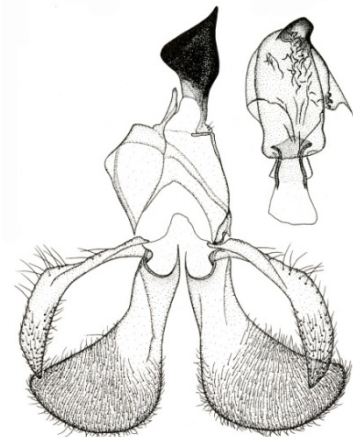
Gelechiidae



Momphidae



Scythrididae



Cosmopterigidae

1. Family Elachistidae

✓ Diversity in North America:

6 subfamilies, 27 genera, 345 species



1. Family Elachistidae

- ✓ Maxillary palpus reduced, one- or two-segmented



Biology of Elachistidae

Larval habits:

- ✓ Leaf tiers, leaf rollers, leaf miners, seed feeders, stem borers, or external feeders on various dicots and monocots



Elachista madarella. Larva, adult and leaf mine on a sedge, *Carex* sp. (Cyperaceae)



Perittia herrichiella. Adult and leaf mine on Eurasian bush honeysuckle, *Lonicera* sp. (Caprifoliaceae)

2. Family Oecophoridae

✓ Diversity in North America:

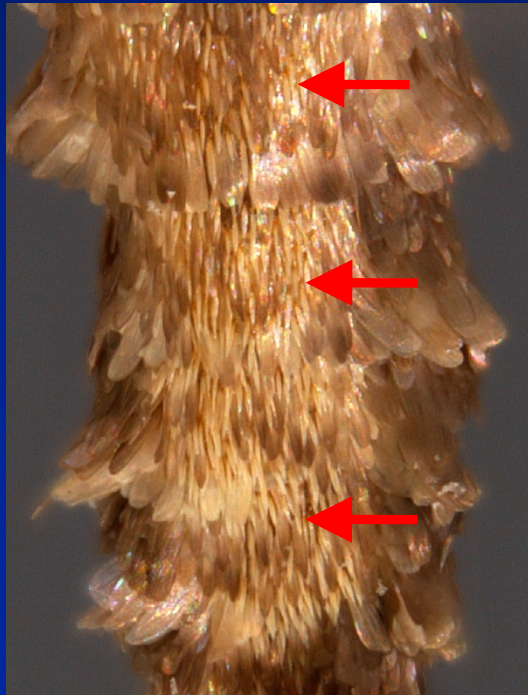
1 subfamily, 21 genera, 39 species

- at least 20 species in the western states



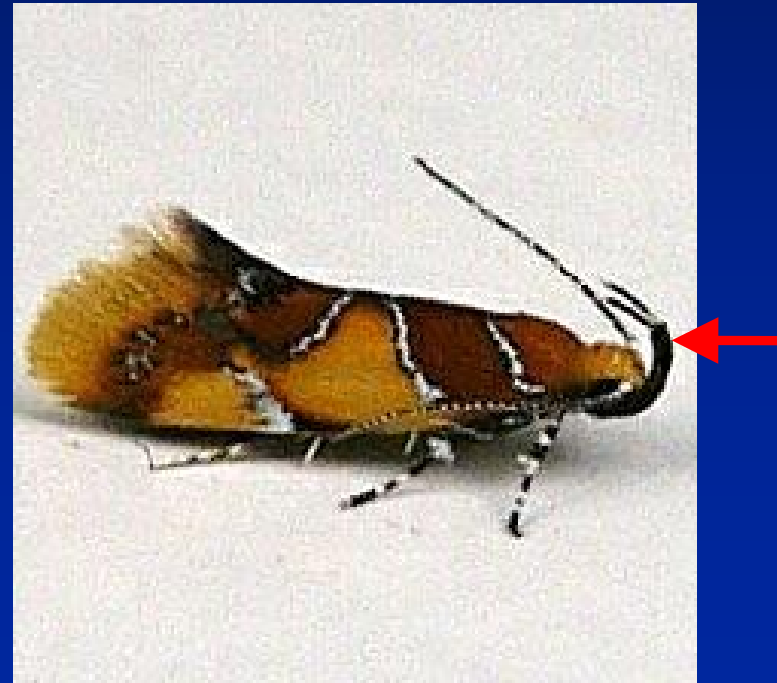
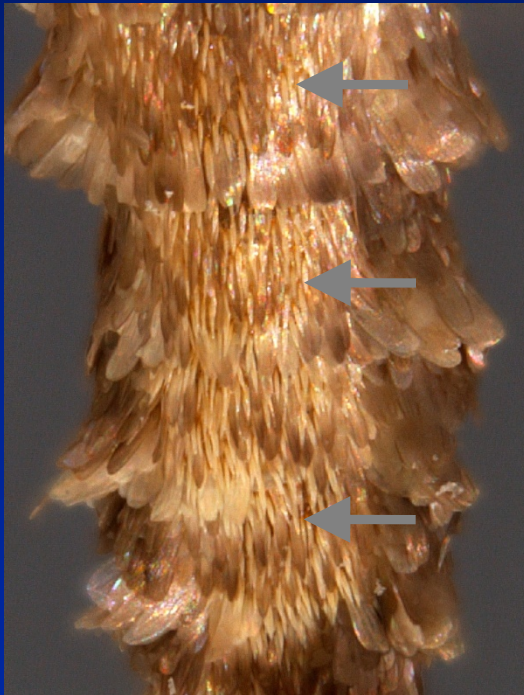
2. Family Oecophoridae

- ✓ Abdominal terga without spiniform setae or with these setae in a broad band



2. Family Oecophoridae

- ✓ Abdominal terga without spiniform setae or with these setae in a broad band
- ✓ Labial palpus often very long and slender



Biology of Oecophoridae

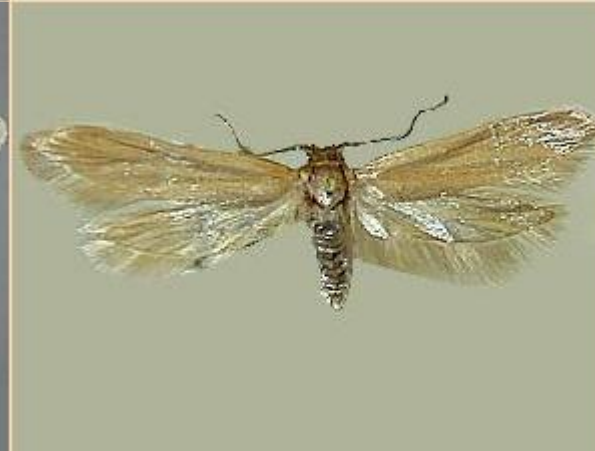
Larval habits:

- ✓ Mainly on dead plant tissue, leaf litter, and other vegetative matter
- ✓ Variety of habits: having portable cases, tunneling into wood, and tying leaves

3. Family Blastobasidae

✓ Diversity in North America:

2 subfamilies, 7 genera, 69 species



3. Family Blastobasidae

- ✓ A row of spiniform setae across each segment of abdomen



3. Family Blastobasidae

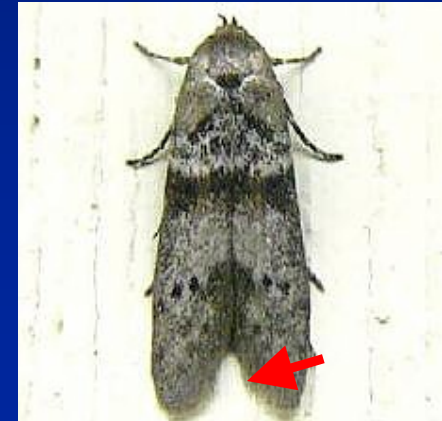
- ✓ A row of spiniform setae across each segment of abdomen
- ✓ Antennae notched in males of some genera



Terry Harrison

3. Family Blastobasidae

- ✓ A row of spiniform setae across each segment of abdomen
- ✓ Antennae notched in males of some genera
- ✓ Resting adults at blacklights with V-shaped separation of apical ends of wings



Terry Harrison

Biology of Blastobasidae

Larval habits:

- ✓ Scavengers on leaf litter
- ✓ Some predators on scale insects
- ✓ Some internal feeders on seeds of Pinaceae or acorns of Fagaceae
- ✓ Some stem borers on grasses



4. Family Coleophoridae

- ✓ Diversity in North America:
1 subfamily, 1 genus, 154 species



4. Family Coleophoridae (Casebearer moths)

- ✓ Antennal pecten present



4. Family Coleophoridae (Casebearer moths)

- ✓ Antennal pecten present
- ✓ Two patches of spiniform setae on each segment of abdomen



4. Family Coleophoridae (Casebearer moths)

- ✓ Antennal pecten present
- ✓ Two patches of spiniform setae on each segment of abdomen
- ✓ Larvae with diverse cases



Biology of Coleophoridae

Larval feeding habits:

- ✓ 34 plant families
 - especially Juncaceae and diverse dicots
- ✓ Internal feeders on leaves, flowers, or seeds in the early instar, then later external feeders bearing cases but mining leaves



Coleophora serratella Left: mine in *Betula pubescens*; Center: very young youth case; Right: case of fullgrown larva

5. Family Momphidae

✓ Diversity in North America:

1 subfamily, 2 genera, 46 species



5. Family Mommphidae

- ✓ Small, narrow-winged moths with two or more tufts of upraised scales usually on the forewing



Terry Harrison

Biology of Momphidae

Larval habits:

- ✓ Internal feeders as stem/flower/fruit borers or leaf miners on living tissue
- ✓ Mainly Onagraceae, also Asteraceae, Fabaceae, and Fagaceae



Adult

Mompha terminella: leaf mine on enchanter's nightshade (Onagraceae).

Terry Harrison



Adult

Mompha rufocristatella. Left: cocoon inside gall; Right: gall on stem of *Gaura biennis* (Onagraceae).

Terry Harrison

6. Family Scythrididae

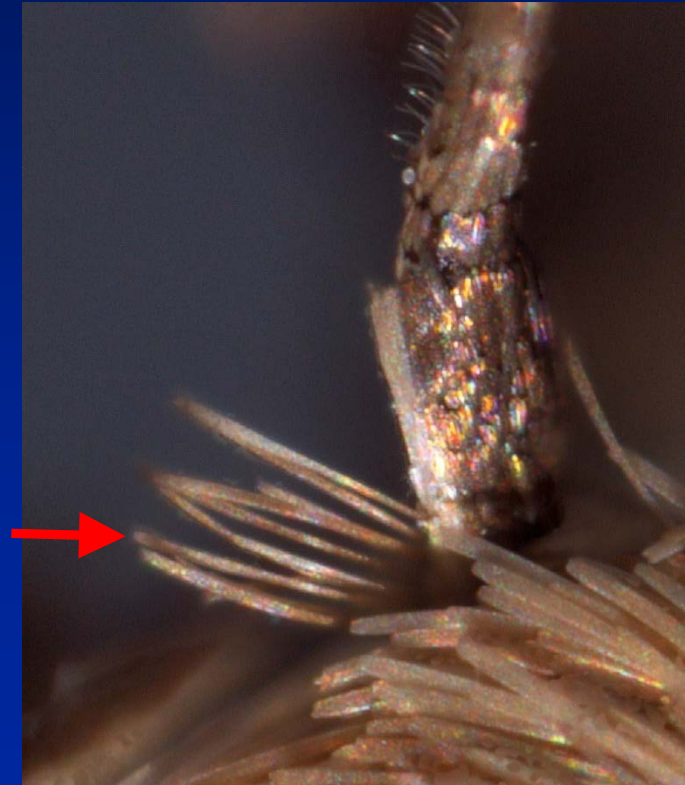
✓ Diversity in North America:

1 subfamily, 6 genera, 42 species



6. Family Scythrididae

✓ Antennal pecten present



6. Family Scythrididae

- ✓ Antennal pecten present
- ✓ Teardrop-shaped at rest



Moth Photographers Group



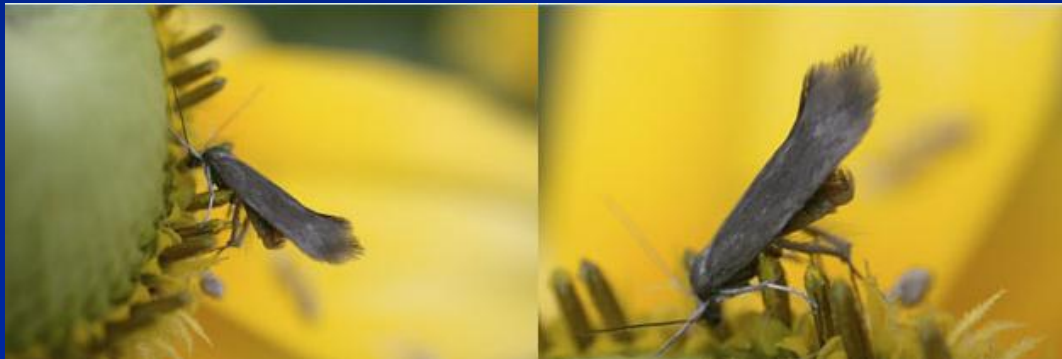
Biology of Scythrididae

Larval habits:

- ✓ External feeders on buds and leaves within weak webs on more than 20 plant families
- ✓ Some leaf miners on Asteraceae

Adults:

- ✓ Many species diurnal and can be found on flowers of hosts or on substrates near the host
- ✓ Some species brachypterous



Scythris immaculatella.
Moth on flower of *Rudbeckia* sp.
(Asteraceae).

Jean-François Landry, Cancoll

7. Family Cosmopterigidae

✓ Diversity in North America:

3 subfamilies, 27 genera, 188 species



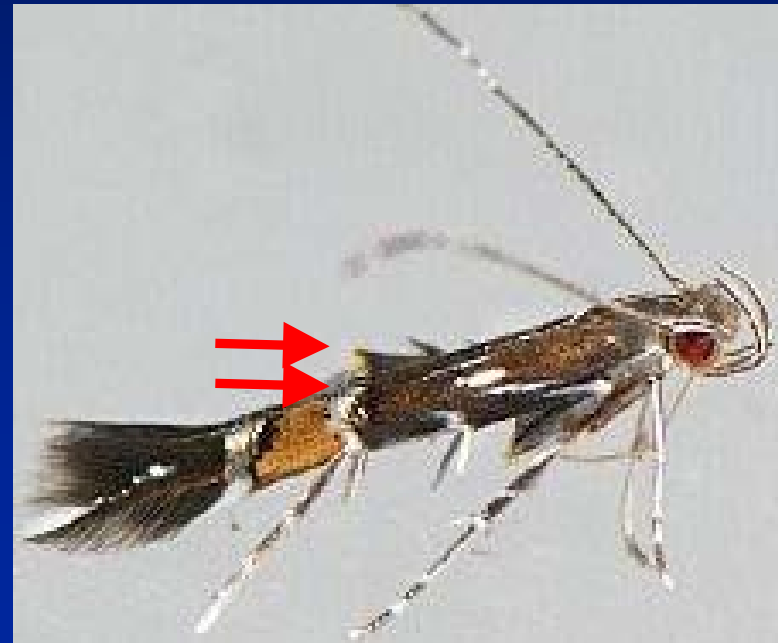
7. Family Cosmopterigidae

- ✓ Fore- and hindwings narrow



7. Family Cosmopterigidae

- ✓ Fore- and hindwings narrow
- ✓ Forewing often with scales forming tubercles



7. Family Cosmopterigidae

- ✓ Fore- and hindwings narrow
- ✓ Forewing often with scales forming tubercles
- ✓ Compound eye incised by inception of antenna



Biology of Cosmopterigidae

Larval habits:

- ✓ Leaf miners, leaf tiers, bark miners, stem/root borers, gall makers, and flower/seed feeders
- ✓ At least 26 families of angiosperms
 - especially Fabaceae, Asteraceae, Cyperaceae, Poaceae, and Rosaceae
- ✓ Larvae of *Euclemensia* parasitoids of Kermes scale insects

9. Family Gelechiidae

- ✓ Diversity in North America:
5 subfamilies, 93 genera, 892 species



8. Family Gelechiidae (Twirler moths)

- ✓ Hindwing usually with outer margin excavated below the apex



Biology of Gelechiidae

Larval habits:

- ✓ Leaf rollers/tiers, seed feeders, gall makers, and leaf/needle miners
- ✓ 82 plant families (Gymnospermae and Angiospermae)

Adults:

- ✓ Mostly flying at dusk or during the night
- ✓ A few diurnal

Which one is the gelechioid?



Which one is the gelechioid?



Name the family?



Name the family?

